

What is claimed is:

CLAIMS:

[C001] 1. A volumetric stationary CT system comprising:
at least one stationary detector extending generally around at least a portion of an imaging volume; and
at least one stationary distributed X-ray source placed proximal to the at least one stationary detector,
wherein the at least one stationary detector and the at least one stationary distributed X-ray source are configured to cooperate to contribute towards completeness in acquired data for image reconstruction.

[C002] 2. The system of claim 1, wherein the at least one stationary distributed X-ray source comprises at least one of thermionic emitters, carbon-based emitters, photo emitters, ferroelectric emitters, cold-cathode emitters, laser diodes and monolithic semiconductors.

[C003] 3. The system of claim 1 further comprising a plurality of detector elements of one or more sizes placed in the at least one stationary detector.

[C004] 4. The system of claim 1, wherein the at least one stationary distributed X-ray source includes one or more full ring sources.

[C005] 5. The system of claim 4, wherein the one or more full ring sources include at least one of a circle, a rectangle, a square, an ellipse, an oval, and a loop configuration.

[C006] 6. The system of claim 4, wherein the at least one stationary detector includes a pair of ring detectors and wherein at least one ring source of the one or more full ring sources is positioned between the pair of ring detectors.

[C007] 7. The system of claim 6 further comprising one or more line sources extending at least along a Z-direction to increase completeness in acquired data for image reconstruction.

[C008] 8. The system of claim 4, wherein the at least one stationary detector includes one or more ring detectors placed between two or more ring sources.

[C009] 9. The system of claim 8 further comprising one or more line sources extending at least along a Z-direction to increase completeness in acquired data for image reconstruction.

[C010] 10. The system of claim 8, wherein the at least one stationary detector comprises one full ring detector placed between two full ring sources.

[C011] 11. The system of claim 10 further comprising one or more line sources extending at least along a Z-direction to increase completeness in acquired data for image reconstruction.

[C012] 12. The system of claim 8, wherein the one or more ring sources include at least two ring sources placed immediately adjacent to the stationary detector and additional ring sources at spaced-apart locations on either side thereof.

[C013] 13. The system of claim 12 further comprising one or more line sources extending at least along a Z-direction to increase completeness in acquired data for image reconstruction.

[C014] 14. The system of claim 8, wherein the one or more ring sources include a plurality of spaced-apart ring sources for emitting radiation, and the at least one stationary detector includes a plurality of ring detectors being positioned between the spaced-apart ring sources for receiving the radiation.

[C015] 15. The system of claim 14 further comprising one or more line sources extending at least along a Z-direction to increase completeness in acquired data for image reconstruction.

[C016] 16. The system of claim 4 further comprising one or more partial ring sources and wherein the at least one stationary detector includes one or more ring detectors positioned between two or more ring sources and includes the one or more partial ring sources.

[C017] 17. The system of claim 4, wherein the at least one stationary detector includes one or more ring detectors positioned between two or more ring sources, wherein the one or more ring detectors and the two or more ring sources comprise different diameters for permitting a telescoping movement of the one or more ring detectors with the two or more ring sources.

[C018] 18. The system of claim 1 further comprising one or more line sources extending at least along a Z-direction to increase completeness in acquired data for image reconstruction.

[C019] 19. The system of claim 1, wherein the at least one stationary detector includes a ring detector and wherein the at least one stationary distributed X-ray source includes one or more partial ring sources flanking the ring detector on alternating sides of the ring detector and configured to emit radiation toward the ring detector.

[C020] 20. The system of claim 19 further comprising one or more line sources line sources extending at least along a Z-direction to increase completeness in acquired data for image reconstruction.

[C021] 21. The system of claim 1, wherein the at least one stationary distributed X-ray source includes one or more partial ring sources and wherein the at least one stationary detector includes one or more notched detectors.

[C022] 22. The system of claim 21, wherein the one or more notched detectors include a partial ring detector, and wherein the one or more partial ring sources extend within notches of the partial ring detector.

[C023] 23. The system of claim 21 further comprising one or more line sources extending at least along a Z-direction to increase completeness in acquired data for image reconstruction.

[C024] 24. The system of claim 21, wherein the one or more notched detectors include at least two notched detectors for receiving the one or more partial ring sources and configured to be combined along the Z-direction to generally surround the imaging volume.

[C025] 25. The system of claim 24 further comprising one or more line sources extending at least along a Z-direction to increase completeness in acquired data for image reconstruction.

[C026] 26. The system of claim 1, wherein the at least one stationary detector includes a helical detector, and wherein the at least one stationary distributed X-ray source includes a helical source placed adjacent to the helical detector.

[C027] 27. The system of claim 26, wherein at least one of the helical source and the helical detector forms a plurality of turns around the imaging volume

[C028] 28. An X-ray imaging system for scanning a volume to be imaged, the system comprising:

at least one stationary distributed X-ray source extending generally around at least a portion of an imaging volume and configured to emanate an X-ray radiation;

a control circuit operably coupled to the at least one distributed X-ray source;
at least one stationary detector for receiving the X-ray radiation after attenuation in the imaging volume and placed proximal to the at least one stationary distributed X-ray source;

a processing circuit operably coupled to the at least one detector and configured to receive the plurality of projection images and to form one or more reconstructed slices representative of the volume being imaged; and

an operator workstation operably coupled to the processing circuit configured to display the one or more reconstructed slices,
wherein the at least one stationary detector and the at least one stationary distributed X-ray source are configured to cooperate to contribute towards completeness in acquired data for image reconstruction.

[C029] 29. The system of claim 28, wherein the at least one stationary distributed X-ray source comprises at least one of thermionic emitters, carbon-based emitters, photo emitters, ferroelectric emitters, cold-cathode emitters, laser diodes and monolithic semiconductors.

[C030] 30. The system of claim 28 further comprising a plurality of detector elements of one or more sizes placed in the at least one stationary detector.

[C031] 31. The system of claim 28, wherein the at least one stationary distributed X-ray source includes one or more full ring sources.

[C032] 32. The system of claim 31, wherein the at least one stationary detector includes a pair of ring detectors and wherein at least one ring source of the one or more full ring sources is positioned between the pair of ring detectors.

[C033] 33. The system of claim 32 further comprising one or more line sources extending at least along a Z-direction to increase completeness in acquired data for image reconstruction.

[C034] 34. The system of claim 31, wherein the at least one stationary detector includes one or more ring detectors placed between two or more ring sources.

[C035] 35. The system of claim 34, wherein the at least one stationary detector comprises one full ring detector placed between two full ring sources.

[C036] 36. The system of claim 34, wherein the one or more ring sources include at least two ring sources placed immediately adjacent to the stationary detector and additional ring sources at spaced-apart locations on either side thereof.

[C037] 37. The system of claim 34, wherein the one or more ring sources include a plurality of spaced-apart ring sources for emitting radiation, and the at least one stationary detector includes a plurality of ring detectors being positioned between the spaced-apart ring sources for receiving the radiation.

[C038] 38. The system of claim 31 further comprising one or more partial ring sources and wherein the at least one stationary detector includes one or more ring detectors positioned between two or more ring sources and includes one or more partial ring sources.

[C039] 39. The system of claim 31, wherein the at least one stationary detector includes one or more ring detectors positioned between two or more ring sources, wherein the one or more ring detectors and the two or more ring sources comprise different diameters for permitting a telescoping movement of the one or more ring detectors with the two or more ring sources.

[C040] 40. The system of claim 28 further comprising one or more line sources extending at least along a Z-direction to increase completeness in acquired data for image reconstruction.

[C041] 41. The system of claim 28, wherein the at least one stationary detector includes a ring detector and wherein the at least one stationary distributed X-ray source includes one or more partial ring sources flanking the ring detector on alternating sides of the ring detector and configured to emit radiation toward the ring detector.

[C042] 42. The system of claim 28, wherein the at least one stationary distributed X-ray source includes one or more partial ring sources and wherein the at least one stationary detector includes one or more notched detectors.

[C043] 43. The system of claim 28, wherein the at least one stationary detector includes a helical detector, and wherein the at least one stationary distributed X-ray source includes a helical source placed adjacent to the helical detector.

[C044] 44. A method of X-ray imaging comprising:
providing at least one stationary detector extending generally around at least a portion of an imaging volume; and
providing at least one stationary distributed X-ray source placed adjacent to the at least one detector configured to emit radiation toward the detector, wherein the at least one stationary detector and the at least one stationary distributed X-ray source are configured to cooperate to contribute towards completeness in acquired data for image reconstruction.

[C045] 45. The method of claim 44 further comprising measuring additional data by employing line sources.

[C046] 46. The method of claim 44 further comprising providing one or more ring detectors placed between two or more ring sources.

[C047] 47. The method of claim 46 further comprising one or more line sources extending at least along a Z-direction for increasing completeness in acquired data for image reconstruction

[C048] 48. The method of claim 44 further comprising reducing scatter by using small cone angles for the distributed X-ray source.

[C049] 49. The method of claim 44 wherein the at least one stationary distributed X-ray source includes at least two ring sources and the at least one stationary detector includes one or more ring detectors, and wherein at least one of a source and a detector is configured to make a telescopic movement for allowing adaptive Z-coverage.

[C050] 50. The method of claim 49 further comprising one or more line sources extending at least along a Z-direction to increase completeness in acquired data for image reconstruction.

[C051] 51. The method of claim 44 further comprising one or more partial ring sources and wherein the at least one stationary detector includes one or more ring detectors positioned between two or more ring sources and includes the one or more partial ring sources.

[C052] 52. The method of claim 44, wherein the at least one stationary detector includes a ring detector and wherein the at least one stationary distributed X-ray source includes one or more partial ring sources flanking the ring detector on alternating sides of the ring detector and configured to emit radiation toward the ring detector.

[C053] 53. The method of claim 52 further comprising one or more line sources line sources extending at least along a Z-direction to increase completeness in acquired data for image reconstruction.

[C054] 54. The method of claim 44, wherein the at least one stationary distributed X-ray source includes one or more partial ring sources and wherein the at least one stationary detector includes one or more notched detectors.

[C055] 55. The method of claim 54 further comprising one or more line sources extending at least along a Z-direction to increase completeness in acquired data for image reconstruction.

[C056] 56. The method of claim 44, wherein the at least one stationary detector includes a helical detector, and wherein the at least one stationary distributed X-ray source includes a helical source placed adjacent to the helical detector.

[C057] 57. The method of claim 44, wherein the at least one stationary detector includes a pair of ring detectors and wherein at least one ring source of the one or more full ring sources is positioned between the pair of ring detectors.

[C058] 58. The method of claim 57 further comprising providing one or more line sources extending at least along a Z-direction to increase completeness in acquired data for image reconstruction.